

Research Article

CRYOSURGICO-THERAPEUTIC MANAGEMENT OF FOOT LESIONS IN ASIAN ELEPHANTS OF ODISHA, INDIA: A REVIEW OF 15 CASES

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ABSTRACT: The present study was conducted on 15 healthy captive and/or wild Asian elephants of Odisha, divided into 3 groups (n=5), for management of different foot affections. Group A was comprised of conventionally treated elephants with surgical debridement of foot lesions followed by regular dressing. Group B and Group C elephants were treated with tip and swab method of cryotherapy, respectively. A non-significant ($p>0.05$) increase in clinic-physiological and haemato-biochemical parameters had been observed; while the rectal temperature increased initially on day 3 followed by decrease in values from 7 days onwards alike a non-significant ($p>0.05$) decrease in TLC and neutrophil (%). It was concluded that as compared to conventional methods, cryotherapy via probe or tip applicator and swab method of freezing proved to be more fruitful in healing of foot lesions.

Key words: Asian elephant, Foot lesion, Cryotherapy.

INTRODUCTION

The anatomy of the foot of an elephant is masterful piece of evolutionary development, a highly evolved appendage that designed to support the enormous weight of the largest terrestrial mammal and withstand enormous concussion (Miller *et al.* 2008). The modern way of countering human-elephant conflict involves using captive trained elephants as koonkies for driving away the crop damaging wild elephant herds but keeping elephants in captivity makes the elephants vulnerable to numerous foot ailments. Foot problems are seen in 50 percent of captive Asian elephants at some time of their lives and foot lesions probably constitute the most numerous and potentially damaging ailments that torment them. The major causes of foot problems are chronically wet and dirty conditions of standing places in captive conditions (Shafiuzaama 2012). The present study was designed to evaluate the efficacy of cryotherapy using liquid nitrogen via swab method and tip method in comparison to conventional method for treatment of foot lesions in captive Asian elephants.

MATERIALS AND METHODS

The present study was conducted on 15 healthy male and female Asian elephants (*Elephas maximus*) as captive

of Chandaka Wildlife Sanctuary, Nandankanan Zoological Park and different forest division areas of Odisha for wild elephants on various incidences of foot affections presented to referral Dept. of Vety. Surgery and Radiology. They were rescued by forest department officials and handed over for treatment, intensive care and management. Different kinds of foot lesions such as over grown nails, over grown cuticle, split nails, cracked sole, pitted sole, septic podo-dermatitis, overgrown sole, over worn sole, cracked heel, ingrown nails, laminitis, injury, abscess, arthritis and interdigital hyperplasia are commonly encountered ones.

The elephants were controlled by their mahunt (the elephant keeper) and darted with tranquilizer gun. Anesthetic cocktail mixture consisted of atropine (anticholinergic), xylazine (sedative and muscle relaxant) and ketamine (dissociative anesthetic) in predetermined doses. The dose of drugs used was xylazine 0.1 mg/kg b.wt. and ketamine 0.3 to 0.7 mg/kg b.wt. intramuscularly (Tranquili 2007).

The animals were divided into 3 groups comprising of 5 animals in each group. All the animals were examined thoroughly for any foot abnormalities in the standing position and then the animals were allowed to walk to identify any signs of lameness.

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Fig. 1. Interdigital hyperplasia at foot.

Group A was comprised of conventionally treated elephants with surgical debridement of foot lesions followed by regular dressing of the lesions (Fig. 2). Group B animals were subjected to tip applicator method of cryotherapy with sufficiently long forceps which was dipped in liquid nitrogen followed by touching the foot lesions with tip acting as cryoprobe (Fig. 4). The rods were cooled by immersing in liquid nitrogen to a length of 2 inches and retained till the boiling noise of liquid nitrogen stopped. The frozen end was applied at the proposed site and held in position till it was detached on its own. Group C comprised of swab method with an absorbent cotton swab of about 1 inch. diameter held at tip of long hemostatic forceps which was dipped in liquid nitrogen till it stopped boiling (Fig. 3). Afterwards, it was applied over the proposed foot lesions and retained in position till it was detached. Parenteral broad-spectrum antibiotics enrofloxacin (Quintas, Intas Pharmaceuticals limited) and analgesics (Melonex, Intas Pharmaceuticals

limited) were also administered once daily for 5 and 3 days respectively. The animal made an uneventful recovery. The aim of application of liquid nitrogen was to save the foot of valuable animal with minimal hemorrhage which was suffering from foot lesions even after conservative treatment.

RESULTS AND DISCUSSION

Cryosurgery (also called cryotherapy) is the use of extreme cold produced by liquid nitrogen (or argon gas) to destroy abnormal tissue. It is used to treat some kinds of cancer and some precancerous or non-cancerous conditions, and can be used inside the body and on the skin (Cooper and Lee 1971).

Cryosurgery may have fewer side effects than other types of treatments, and is less expensive and requires shorter recovery times (Farris *et al.* 1975). Cryosurgery offers advantages over other methods of cancer treatment. It is less invasive than surgery, involving only a small incision or insertion of the cryoprobe through the skin (Krahwinkel *et al.* 1976). Consequently, pain, bleeding, and other complications of surgery are minimized.

A non-significant ($p>0.05$) increase in heart rate and respiration rate was recorded in the animals of all groups from day 0 onwards till completion of the observation period. Rectal temperature increased initially on day 3 of the observation period followed by non-significantly ($p<0.05$) decreased values as compared to the base values till completion of the observation period. Hemoglobin and PCV values recorded non-significant ($p>0.05$) increase as compared to baseline value in the animals of all groups.

A non-significant ($p>0.05$) increase in HR and RR values was recorded from day 0 onwards till day 21. However, at the end of the observation period (day 28),



(A)



(B)

Fig. 2. (A and B): Topical application of antibiotics and fly repellent at hyperplastic growth site.



Fig. 3. Swab cryo application.

HR values were non-significantly ($p>0.05$) decreased than the base values while RR was non-significantly ($p>0.05$) different than the base value. Rectal temperature remained non-significantly ($p>0.05$) increased in the animals on day 3 followed by non-significant ($p>0.05$) decrease in RT values from day 7 onwards till completion of the observation period. The slight variation in physiological parameters in the present study was within the normal physiological limit which has also been reported following use of swab method of cryotherapy by Nath (2001).

Hemoglobin values remained significantly ($p<0.05$) increased on day 3 followed by non-significantly ($p>0.05$) increased Hb values on day 7 and 14. However, the values were non-significantly ($p>0.05$) decreased as compared to the base values from day 21 onwards till end of the observation period. Packed cell volume values remained significantly ($p<0.05$) increased in the animals on day 3 followed by non-significantly ($p>0.05$) increased PCV values on day 7 and 14. However, the values were non-



Fig. 4. Tip cryo application.

significantly ($p>0.05$) different from the base value on day 21 followed by non-significantly ($p>0.05$) decreased PCV values as compared to the baseline on day 28. The marginal changes in Hb and PCV value may be attributed to transient pooling of red blood cells during surgical debridement. The gradual increase or decrease as observed in the animals in present study which underwent cryosurgery was within the normal physiological limit which has also been reported by Nath (2001).

No significant change in any blood parameter (Hb, PCV) was found among the animal during the treatment period except (TLC, neutrophil and lymphocyte count). A non-significant ($p>0.05$) decrease in TLC value was recorded in the animals at most of the time intervals throughout the observation period except for non-significantly ($p>0.05$) increased values on day 7. A non-significant ($p>0.05$) decrease in neutrophil count was recorded in the animals throughout the observation period except for non-significantly ($p>0.05$) increased values on day 14 of the observation period. The values of



Fig. 5. Instant 2nd time application after detachment.



Fig. 6. Foot showing complete recovery after cryotherapy treatment.

Table 1. Clinicophysiological and haematobiochemical values in treated elephants (Mean±SE).

Parameter	0 day	3day	7day	14day	21day	28day
Heart rate (beats/min)	30.60±1.60	31.80±1.16	32.40±0.98	31.80±0.86	31.60±1.21	30.40±0.93
Respiration rate (breaths/min)	8.40±0.75	8.60±0.75	8.80±1.02	9.20±0.86	10.40±0.51	8.40±1.08
Rectal temperature (°C)	36.51±0.14	36.69±0.09	36.43±0.07	36.34±0.05	36.37±0.07	36.38±0.11
Haemoglobin (g/L)	144.80±7.50	153.16±7.6*	150.06±8.62	148.68±5.9	144.09±9.12	140.76±7.63
Packed cell volume (L/L)	0.48±0.02	0.51±0.03*	0.50±0.03	0.50±0.02	0.48±0.03	0.47±0.03
Total leukocyte count ($\times 10^9/\text{L}$)	14.93±0.73	14.61±0.46	15.01±0.85	14.50±0.34	14.34±0.74	14.10±0.75
Neutrophil count (%)	40.60±1.81	40.20±0.86	39.80±1.71	41.40±2.16	39.60±1.78	38.60±1.21
Lymphocyte count (%)	51.60±2.16	53.40±1.81	53.20±1.71	54.40±1.78	55.80±0.86	55.40±1.21
Glucose (mmol/L)	4.24±0.54	4.41±0.42	4.61±0.34	4.70±0.36	4.63±0.31	4.90±0.31
Urea nitrogen (mmol/L)	4.79±0.30	4.88±0.33	4.95±0.30	4.63±0.31	4.47±0.37	4.36±0.38
Creatinine ($\mu\text{mol}/\text{L}$)	154.62±14.8	164.25±11.4	166.09±12.7	178.92±10.5*	169.53±15.94	171.91±12.18

* Significantly different from the base value ($p<0.05$).

neutrophil might increase due to surgical stress and it returned back to normal range after few days (Shastri 1982). A non-significant decrease in TLC value might be due to adrenocortical stimulation and subsequent effect of glucocorticoids on circulating neutrophils and lymphocytes as opined by (Schalm 1965). A non-significant ($p>0.05$) increase in lymphocyte count was recorded in the animals throughout the observation period. (Holden 1972) has also reported an increased lymphocytic activity following cryo-destruction of tumors.

A non-significant ($p>0.05$) increase in plasma glucose value was recorded in the animals throughout the observation period. The increase in glucose values as observed in present study was within the normal physiological limits for an elephant and it might be due to return of normal activity of the animal and feeling of comfort to the animal which could have led to increased intake of feed and fodder. Plasma urea nitrogen values recorded a non-significant ($p>0.05$) increase in the animals on day 3 and 7. However, the values remained non-significantly ($p>0.05$) decreased as compared to the base values from day 14 onwards till completion of the observation period. The increase or decrease in PUN values in the present study was within normal physiological range and the increased values might be due to increased intake of feed and fodder leading to increased breakdown of protein and non-protein nitrogen (NPN) compounds leading to more production of urea by liver and subsequent excretion in urine (Kaneko 1997). Increased globulin secretion following cryotherapy as stated by (Benzamin 1989) might be another probable cause for increased degradation of protein components

leading to increase in PUN values. (Bright and Lantz 1985) also stated that patient enters catabolic stage after surgical intervention as revealed by decreased plasma protein level due to increased breakdown of protein. This increased breakdown may also have led to increase in PUN values in the initial days during the present study. A non-significant ($p>0.05$) increase in creatinine values was recorded in the animals at most of the time intervals throughout the observation period except for significantly ($p<0.05$) increased creatinine values on day 14. The non-significant changes in creatinine level with the values remaining within the normal physiological limits following cryotherapy has also been reported by Nath (2001).

The cryo-frozen area appeared pale followed by edema and swelling with loss of sensation, immediately after freezing. Subsequently, there was brown to dark coloration of surface, necrosis of the tissues and eschar formation which gradually sloughed off. Regression of the growths and healing of the cryo-lesions occurred without any complications. Administration of parenteral enrofloxacin has also been found to be better as compared to other conventional antibiotics in treating foot lesions in captive Asian elephants (Sarma *et al.* 2012).

Cryotherapy has been used for long periods to destroy abnormal tissue and it has also been found to assist in treatment of different kinds of cancer and some precancerous or non-cancerous conditions inside the body or over the skin (Cooper and Lee 1971). Cryosurgery has been found to have very fewer side effects than other types of treatments, and is less expensive and requires shorter recovery time (Farris *et al.* 1975). Additional advantages of using cryosurgery over other methods of

cancer treatment include less invasiveness than surgery and involving only a small incision over the skin which consequently minimizes pain, bleeding and other complications of surgery (Brizel *et al.* 2008).

It was concluded that swab method of cryotherapy incites transient changes in clinic-physiological and haemato-biochemical parameters in captive elephants, which returned to the normal after few days and therefore, can be used safely for management of foot affections.

CONCLUSION

Conventionally treated elephants with surgical debridement of foot lesions revealed more hemorrhage and delayed healing. Studies on different methods of freezing indicated similar type of changes like pale coloration followed by edema and swelling with loss of sensation, immediately after freezing. Subsequently, there was brown to dark coloration of surface, necrosis of the tissues and eschar formation which gradually sloughed off.

Debulking of growths and freezing was carried out wherever the growths were bulky. Regression of the growths and healing of the cryo-lesions occurred in both the methods of freezing, but the number of applications in each method varied. 2 to 3 and 4 to 5 applications at 7 days interval each were required in probe method and swab method respectively.

Ice crystal formation was more severe in swab method than tip applicator method with liquid nitrogen. The cryosurgery lesion healed completely in both groups within 3 to 5 weeks depending on the size of foot lesion.

So, it can be concluded that

1. Cryosurgery by tip applicator as well as swab method is an effective method to treat foot lesions in both captive as well as wild Asian elephants.

2. Cryosurgery has a little effect on hematological and biochemical parameters in Asian elephants.

3. The stress of radical surgery can be replaced by cryo-application due to its easy method of application and minimal animal preparation and handling for the procedure.

4. The septic pododermatitis, overgrown sole, interdigital hyperplasia and other foot lesions can be successfully treated by cryofreezing.

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